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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/632,825	08/04/2003	Yun-Jung Lee	9862-000016/US	9195

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EXAMINER	
PERT, EVAN T	

ART UNIT	PAPER NUMBER
2826	

DATE MAILED: 10/17/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

EC

Office Action Summary	Application No.	Applicant(s)	
	10/632,825	LEE ET AL.	
	Examiner	Art Unit	
	Evan Pert	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *31 May 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *23 and 24* is/are allowed.

6)☒ Claim(s) *1-22,25 and 26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *31 May 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement filed August 3, 2005 fails to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) for the "Korean Office Action" in Korean. The IDS filed August 3, 2005 has been placed in the application file, but the information referred to therein has not been considered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-14 and 26 are rejected under 35 U.S.C. 102(e) as being anticipated by Metzner et al. (US 2003/0232511 A1) in view of secondary references to Ohring, iupac.org, and Lee et al. showing universal fact:

Secondary References – Evidence of Universal Fact

The Ohring reference and the web article to iupac.org entitled "chemisorption and physisorption" are relied on as evidence of the meaning of the word "adsorbed" in the Metzner et al. reference:

When something is "adsorbed" that something has by definition undergone "adsorption", wherein "adsorption" inherently includes two types of adsorption, namely 1) "physical adsorption" or "physisorption" and 2) "chemical adsorption" or "chemisorption". [See sentence bridging p. 339 to 340 of the Ohring reference and the explanation of "chemisorption and physisorption" by the web article http://www.iupac.org/reports/2001/colloid_2001/manual_of_s_and_t/node16.html].

The examiner relies on the Lee et al. article to establish *universal fact* about the meaning of "ALD" in the Metzner et al. reference, in that the "adsorbed" precursor inherently refers to both "chemisorbed precursor" (that creates a monolayer in the ALD process) and "physisorbed precursor" (that is purged with other reactants before another monolayer is formed by chemisorption in the ALD process):

> ***ALD is*** a variation of CVD in which there is an alternating cyclic supply of the gaseous precursors to the substrate. During each injection step, ***chemisorption*** of the precursor involves the formation of relatively strong bonds, whereas in ***physisorption***, the effective forces are of the weak van der Waals type. ***Physisorption*** is fast and always reversible, ***and the subsequent purging step removes the physisorbed precursor*** and the reaction products before injection of the next reactant. In ***chemisorption***, only ***one atomic or molecular layer can adhere*** to the substrate, so ***growth is self-limiting*** and is insensitive to pressure and substrate changes.
>
> [Lee et al., p. C91, 2nd paragraph, emphasis added].

Primary Reference – Anticipates with "adsorbed" inherently including "chemisorbed"

Regarding claim 1, the claimed "exposing" and "oxidizing" steps are disclosed, for example, at [0011] of the Metzner et al. reference, as an "ALD" process using a precursor of "TDEAH" that *inherently* forms a "chemisorbed" precursor layer on the substrate (wherein the word "chemisorbed" is disclosed as "adsorbed," inherently including the "chemisorbed" type of adsorption forming a monolayer and the "physisorbed" type of adsorption of excess precursor that is "purged" per [0021]), wherein the chemisorbed layer is subsequently oxidized with "ozone" or "oxygen radicals" to form "hafnium oxide." "TDEAH" inherently includes an "amino functional group," by its definition (e.g. per [0018] of the specification).

Regarding claims 2-4, in the Metzner et al. reference, the "M" is "hafnium" ([0019], [0020]) and "X" represents "-NR_1R_2" wherein R_1 and R_2 are independently selected from a group consisting of hydrogen and alkyl groups [0020].

Regarding claim 5, the "most preferred" is "TDEAH" [0020].

Regarding claims 6-7, an exemplary "oxidant" is "ozone" (i.e. O_3) [0022].

Regarding claim 8, the steps added to limitations of claim 1 addressed above merely add aspects to the scope of claim 1 that are *implied* by "ALD" of "semiconductor films such as high k gate dielectric layers or high k capacitor dielectric layers" [0011]. The linguistically claimed steps of claim 8 that are implied are also *conceptually* disclosed at [0006] with [0011] taken with [0019] to [0022].

Regarding claim 9, the "most preferred" precursor is "TDEAH" [0020].

Regarding claims 10 and 11, an exemplary "oxidant" is "ozone" (i.e. O_3) [0022].

Regarding claim 12, the reference to Metzner et al. anticipates values among the ranges that are claimed because the reference discloses "between about 150°C and 220°C" with a pressure of "from 0.1 to 10 Torr" [0021], and the precursor gets introduced into the chamber using a carrier gas such as nitrogen or argon (the nitrogen and argon inherently being "inert") [0021].

Regarding claim 13, as is a definition of "ALD," the "deposition" and "purge" are repeated as "cycles" [0022].

Regarding claim 14, the "removing" step is anticipated by the Metzner et al. reference, conceptually embodied as language that concludes: "the purge gas need only last long enough to clear the excess TDEAH from the chamber" [0021].

Regarding claim 26, "TDEAH" is an exemplary precursor that falls within the scope of this genus claim, by applicant's own disclosure, for example [0018], and the Metzner et al. reference finds "TDEAH" to be the "most preferred" [0020].

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 15-22 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Metzner et al., as applied to claims 1-14 and 26 above, and further in view of Basceri et al. (US 6,753,618 B2).

While the drawings in the Metzner et al. reference include capacitors and other depictions, the examiner does not particularly rely on any drawings in the Metzner et al. reference, as they are misplaced drawings, not corresponding to the text of the disclosure of Metzner et al. (e.g. descriptions [0012] through [0018] clearly do not correspond to the Figures).

Since Metzner et al. does not explain any of the drawings that are misplaced, the material in the drawings is not a proper disclosure to be relied on by the examiner. The Metzner et al. reference is relied on only as saying that the ALD disclosed (using TDEAH with ozone to form hafnium oxide) is suitable for forming "semiconductor films such as high k gate dielectric layers or high k capacitor dielectric layers" [0011].

Regarding claims 15 and 25, therefore, with the above explanation, the portion of the Metzner et al. reference properly relied on is silent about any particular way of *how* to make a capacitor, but does disclose that the hafnium oxide formed by the inventive method is good as a capacitor dielectric, which means that the Metzner et al. reference motivates one of ordinary skill in the art to use the method to "form a capacitor".

As a chosen example, Baceri et al. discloses methodology for making capacitors as part of semiconductor devices [abstract], wherein a first electrode (62) is formed on a semiconductor substrate (13) (i.e. the claimed step a), forming a capacitor dielectric (80) (ALD, but different than that of the claimed steps b and c), and forming a second electrode on the dielectric layer (90) (i.e. the claimed step d).

It would have been obvious to one of ordinary skill in the art at the time of the claimed invention to adopt the method of forming hafnium oxide as a capacitor dielectric disclosed in the Metzner et al. reference as the capacitor dielectric (80) in the Basceri et al. reference, thus adopting the claimed steps b and c as they are discussed in the rejection of claim 1.

One of ordinary skill in the art would have been motivated to adopt the hafnium-oxide-capacitor-dielectric forming-method disclosed in the Metzner et al. reference to form capacitor dielectric (80) disclosed in the Basceri et al. reference because the method of the Metzner et al. reference, unlike anything disclosed in the Basceri et al. reference, can produce a high k capacitor dielectric that does not contain detectable amounts of carbon [0039] wherein the carbon is unwanted [0007].

Regarding claims 16 and 17, in adopting the method of Metzner et al. in the device of Basceri et al. as stated for the rejection of claim 15, one would use "TDEAH" as the "most preferred" and would use "ozone" as an exemplary oxidant for reacting the precursor during an ALD cycle.

Regarding claim 18, the claimed aspect ratio of "at least 10:1" is not specifically stated in the Basceri et al. reference, yet the Metzner et al. reference explains that "aspect ratios of 10 or greater are contemplated" [0005], so it would have been obvious to one of ordinary skill in the art at the time of the claimed invention to make the basceri et al. capacitor (100) aspect ratio greater than 10:1, motivated to put more capacitors in a smaller area of integrated circuit chip, and being able to coat the feature having such a high aspect ratio by the ALD process using hafnium oxide with TDEAH and ozone as disclosed by the Metzner et al. reference [0005]-[0006] (see MPEP 2144).

Regarding claims 19 and 20, in adopting the method of Metzner et al. to form dielectric (80) in Basceri et al., the first electrode is a multi-layer of doped polysilicon (62) and metal nitride (70), for example.

Regarding claim 21, in adopting the method of Metzner et al. to form dielectric (80) in Basceri et al., the second electrode is a metal nitride (90), for example.

Regarding claim 22, the Metzner et al. reference implicitly discloses the claimed steps b-e in that ALD cycles are repeated using TDEAH as a precursor and ozone as an oxidant such that one complete ALD cycle corresponds to the claimed steps b-c and a second cycle depositing another layer to thicken the hafnium oxide corresponds to claimed steps d-e [0006]-[0011].

Therefore, the claimed steps b-d are practiced for forming the hafnium oxide capacitor dielectric (80) in Basceri et al. more than one atomic layer thick in accordance with the method of Metzner et al., with the electrode formation of steps a and f corresponding the formation of electrode 62/70 and electrode 90 in Basceri et al..

For this rejection, the "first precursor" and the "second precursor" are the same type, but are introduced during different cycles [with claim 23 clearly limited to the "first" and "second" precursors being "different" types, not just different times of use].

Allowable Subject Matter

4. Claims 23-24 are allowed.

Response to Arguments

5. Applicant's arguments filed May 31, 2005 have been fully considered but they are not persuasive:

The foundation of applicant's arguments purports that the prior art "adsorbed" somehow does not disclose the claim term "chemisorbed".

Yet, as a *universal fact*, when something is "adsorbed," by definition, that something is inherently "chemisorbed" or "physisorbed" (see web article "Chemisorption and physisorption").

Particularly, in "ALD" of the Metzner et al. reference, even though "adsorbed" is the word used, both "chemisorption" and "physisorption" occur, wherein the chemisorbed precursor remains when the physisorbed precursor is purged (see Lee et al. paper, 2nd paragraph, p.C91).

Applicant's argument that the Metzner et al. reference merely discloses "adsorbed" and not "chemisorbed" is a bogus argument because the "adsorbed" in the Metzner et al. reference *inherently* includes a "chemisorbed" precursor for a monolayer of the ALD; if no "chemisorbed" precursor forms, the "purging" at [0021] would clear all precursor, since "the subsequent purging step" in an "ALD" process "removes physisorbed precursor before injection of the next reactant" [Lee et al.].

By the definition of "ALD", then, a monolayer of "chemisorbed" precursor remains after purging, which is a monolayer having "self-limiting growth" which is "insensitive to pressure and substrate changes" (Lee et al. paper, 2nd paragraph, p.C91).

Applicant's argument that "chemisorbed" is not inherent to the "adsorbed" of the Metzner et al. reference is ill founded and not persuasive.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Evan Pert whose telephone number is 571-272-1969. The examiner can normally be reached on M-F (7:30AM-3:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ETP
October 13, 2005

EVAN PERT
PRIMARY EXAMINER